Potential Use of In Situ Material Composites Such as Regolith/Polyethylene for Shielding Space Radiation

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NASA has an extensive program for studying materials and methods for the shielding of astronauts to reduce the effects of space radiation when on the surfaces of the Moon and Mars, especially in the use of in situ materials native to the destination reducing the expense of materials transport. The most studied material from the Moon is Lunar regolith and has been shown to be as efficient as aluminum for shielding purposes (1). The addition of hydrogenous materials such as polyethylene should increase shielding effectiveness and provide mechanical properties necessary of structural materials (2). The neutron radiation shielding effectiveness of polyethylene/regolith stimulant (JSC-1A) composites were studied using confluent human fibroblast cell cultures exposed to a beam of high-energy spallation neutrons at the 30°-left beam line (ICE house) at the Los Alamos Neutron Science Center. At this angle, the radiation spectrum mimics the energy spectrum of secondary neutrons generated in the upper atmosphere and encountered when aboard spacecraft and high-altitude aircraft. Cell samples were exposed in series either directly to the neutron beam, within a habitat created using regolith composite blocks, or behind 25 g/cm2 of loose regolith bulk material. In another experiment, cells were also exposed in series directly to the neutron beam in T-25 flasks completely filled with either media or water up to a depth of 20 cm to test shielding effectiveness versus depth and investigate the possible influence of secondary particle generation. All samples were sent directly back to JSC for sub-culturing and micronucleus analysis. This presentation is of work performed in collaboration with the NASA sponsored Center for Radiation Engineering and Science for Space Exploration (CRESSE) at Prairie View A&M.

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